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THEME:
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ON

10TH OCTOBER, 2019

AT

ASUU CONFERENCE HALL, UNIVERSITY OF JOS, PLATEAU STATE, NIGERIA, WEST-AFRICA.

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Vol. 8 No. 1, October 10th, 2019, *ASUU Conference Hall, University of Jos, Plateau State, Nigeria, West-Africa.*

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Proceedings

The Academic Conference of Nightingale Publications and Research International on Sub-sahara African Sustainable Development: Inter-disciplinary Approach, Vol. 8 No.1, 10th October, 2019- ASUU Conference Hall, University of Jos, Plateau State, Nigeria, West-Africa.

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TOPOGRAPHIC EFFECT ON THE OCCURRENCE AND INTENSITY OF THUNDERSTORM IN PARTS OF NORTH CENTRAL NIGERIA

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Abstract
Topography as one of the major factors or lifting mechanism for thunderstorm development which is prominently identified in this study area and this research work is intended to establish the relationship existing between topography and thunderstorm development and occurrence over the region under study. The aim of this study is to examine the effect of topography on the occurrence and intensity of thunderstorm in parts of Guinea Savanna part of Nigeria. The data used for this paper were secondary data. These basically include number of monthly thunderstorms occurrence, wind gustiness associated with the thunderstorms and total monthly rainfall. To achieve the stated aim, descriptive and inferential statistical analysis was use to analyze and compare the data collected. These include line graph and trend analysis. The results revealed that places with low topography has the tendency of low thunderstorm while places with high topography has the tendency of higher number of thunderstorm occurrences as well as high intensity. Another significant finding is that gusty winds of 100km/h and rainfalls of between 30 to 90mm are recorded in few hours of between 3 to 6 hours which are capable of destructions of buildings/structures as well inducing flash flood disasters as seen from the analyzed data. It's therefore recommended that, there should be a proper way of classifying/categorizing data relating to thunderstorm intensity, rainfall amount and frequency of lightening data for easy access on request.

Keywords: *Topographic, Thunderstorm, Occurrence, and Intensity*

Introduction

The simple meaning of a thunderstorm is a local storm that produces thunder and lightning. Several definitions have been given about thunder-storm ranging from being merely a storm containing lightning and thunder (Ahrens, 2010; Ochei *et al.*, 2015). The storm can either be a single cumulonimbus cloud, a cluster of several thunderstorms, or a line of thunderstorms. In order for thunderstorms to form, there

needs to be Moisture - to form clouds and rain, Unstable air - warm air that can rise rapidly and Lift a cold or warm fronts, sea breezes, mountain barriers or the sun's heat capable of lifting air to help initiate thunderstorms development. To being a convective storm that is accompanied by lightning, thunder and other variety of weather such as local heavy shower, hails, gusty wind, sudden temperature change and occasionally tornadoes (Ochei *et al.,* 2015).

In modern socio-economic assessment, weather prediction has become all-important. This is because weather hazards are inimical to the sustenance of any sector of economy. Therefore, there is great need to issue early warnings as well as accurate weather prediction. Weather forecasting in Nigeria predicts weather, for early warning by use of conventional method, which has been inaccurate and unreliable for so long, and the acquisition of such data is usually time consuming. This has consequences on the different sectors of the country and to human lives. Thunderstorm and its related activities influence the lives of people in the tropics and of special concern is its relationship with rainfall, which dictates the farming or agricultural calendar in the tropics (Alexander, 2015). Thunderstorm phenomenon is vital to geographers, especially the climatologist and meteorologist realizing that it is an important hazard to aviation industries (Alexander, 2015).

Thunderstorm development and occurrences is one basic feature of tropical weather systems which have been prominently identified with the study area and a careful and scientific study of this region will in the long run enhance forecasting skill of meteorological forecasters in Nigeria.

As severe storms move through regions of higher (lower) surface θe and ingest the more (less) buoyant air, their updrafts will intensify (weaken) (all else being equal). Although mesoscale environmental effects on storm structure and lightning production were postulated, the θe analysis in Smith *et al.* (2000) and Lawrence (2002).

The two noteworthy ways thunderstorms moves are by means of shift in weather conditions of the wind and spread along outpouring limits towards wellsprings of more prominent warmth and dampness. Numerous convective storms move with the mean wind speed through the Earth's troposphere, or the most reduced 8 kilometers (5.0 mi) of the Earth's environment. More youthful convective storms are controlled by winds closer to the Earth's surface than more develop rainstorms, as they are less tall. Sorted out, enduring electrical storm cells and buildings move at a right point to the bearing of the vertical wind shear vector. In the event that the blast front, or driving edge of the outpouring limit, races in front of the thunderstorm, its movement will quicken in coupled. This is to a greater extent a variable with thunderstorms with overwhelming precipitation (HP) than with storms with low precipitation (LP). At the point when

convective storms blend, which is in all probability when various rainstorms exist in nearness to one another, the movement of the more grounded electrical storm ordinarily manages future movement of the consolidated cell. The more grounded the mean wind, the more improbable different procedures will be included in tempest movement. On climate radar, tempests are followed by utilizing an unmistakable element and following it from sweep to filter (Ologunorisa and Alexander, 2017).

Topography as one of the major factors or lifting mechanism for thunderstorm development which is prominently identified in this study area and this research work is intended to establish the relationship existing between topography and thunderstorm development and occurrence over the region under study, also to show how its contribute to the seasonal unset and secession of the raining season to see how this can enhance the tracking and forecasting thunderstorms for the adjoining low land areas or the lee word side of the relief. These study seeks to fill in the gap of sited above for emergency preparedness and disaster management in Nigeria especially in the Guinea Savannah region of Nigeria. The aim of this study is to examine the effect of topography on the occurrence and intensity of thunderstorm in parts of Guinea Savanna part of Nigeria.

Materials and Methods

The data for the research was sourced from Nigerian Meteorological Agency (NIMET). The data used for this paper were secondary data. These basically include number of monthly thunderstorms occurrence, wind gustiness associated with the thunderstorms and total monthly rainfall. To achieve the stated aim, descriptive and inferential statistical analysis was use to analyze and compare the data collected. These include line graph and trend analysis and World Meteorological Organization (WMO) classification table for thunderstorms was use to compare and classify thunderstorm in the study area.

Results and Discussion

Table 1: Minna thunderstorm, wind and rainfall record of 2010

MONTH	NUMBER OF THUNDERSTORM OCCURANCE	MAX WIND GUST	RAINFALL (mm)
MARCH	12	52.5	58.70
APRIL	24	87.5	37.10
MAY	5	74.5	10.8
JUNE	19	33	106.10
JULY	36	55.5	124.20
AUGUST	19	29.5	158.50
SEPTEMBER	45	126	320.40

OCTOBER	9	48	28.30

Sources: NIMET, 2019

Table 2: Minna thunderstorm, wind and rainfall record of 2011

MONTH	NUMBER OF THUNDERSTORM OCCURANCE	MAX WIND GUST	RAINFALL (mm)
MARCH	11	95	58.70
APRIL	21	87.5	37.10
MAY	5	74.5	10.8
JUNE	17	33	106.10
JULY	31	55.5	124.20
AUGUST	19	29.5	158.50
SEPTEMBER	45	126	320.40
OCTOBER	6	48	28.30

Sources: NIMET, 2019

Table 3: Minna thunderstorm, wind and rainfall record of 2012

MONTH	NUMBER OF THUNDERSTORM OCCURANCE	MAX WIND GUST	RAINFALL (mm)
MARCH	12	95	58.7
APRIL	24	87.5	37.1
MAY	5	74.5	10.8
JUNE	19	33	106.1
JULY	36	55.5	124.2
AUGUST	19	29.5	158.5
SEPTEMBER	45	126	320.4
OCTOBER	7	48	28.3

Sources: NIMET, 2019

Table 4: Minna thunderstorm, wind and rainfall record of 2013

MONTH	NUMBER OF THUNDERSTORM OCCURANCE	MAX WIND GUST	RAINFALL (mm)
MARCH	12	95	58.7
APRIL	24	87.5	37.1
MAY	5	74.5	10.8
JUNE	19	33	106.1
JULY	36	55.5	124.2
AUGUST	19	29.5	158.5
SEPTEMBER	45	126	320.4
OCTOBER	7	48	28.3

Sources: NIMET, 2019

Table 5: Minna thunderstorm, wind and rainfall record of 2014

MONTH	NUMBER OF THUNDERSTORM OCCURANCE	MAX WIND GUST	RAINFALL (mm)
MARCH	5	0	10.2
APRIL	6	33.5	39.7
MAY	18	65.5	77.9
JUNE	18	49.5	136.9
JULY	23	28.5	134.9
AUGUST	35	50.5	170.2
SEPTEMBER	31	0	79.7
OCTOBER	25	33.5	97.1

Sources: NIMET, 2019

Table 6: Minna thunderstorm, wind and rainfall record of 2015

MONTH	NUMBER OF THUNDERSTORM OCCURANCE	MAX WIND GUST	RAINFALL (mm)
MARCH	12	95	58.7
APRIL	24	87.5	37.1
MAY	5	79.5	10.8
JUNE	19	33	106.1
JULY	36	55.5	124.2
AUGUST	19	29.5	158.5
SEPTEMBER	45	126	320.4
OCTOBER	7	48	28.3

Sources: NIMET, 2019

Table 7: Minna thunderstorm, wind and rainfall record of 2016

MONTH	NUMBER OF THUNDERSTORM OCCURANCE	MAX WIND GUST	RAINFALL (mm)
MARCH	2	39.5	9.4
APRIL	9	49.5	22.6
MAY	17	75	34.3
JUNE	34	29	141.4
JULY	33	47.5	106.4
AUGUST	35	44.5	250
SEPTEMBER	43	73.5	296

OCTOBER	34	114.5	144.7

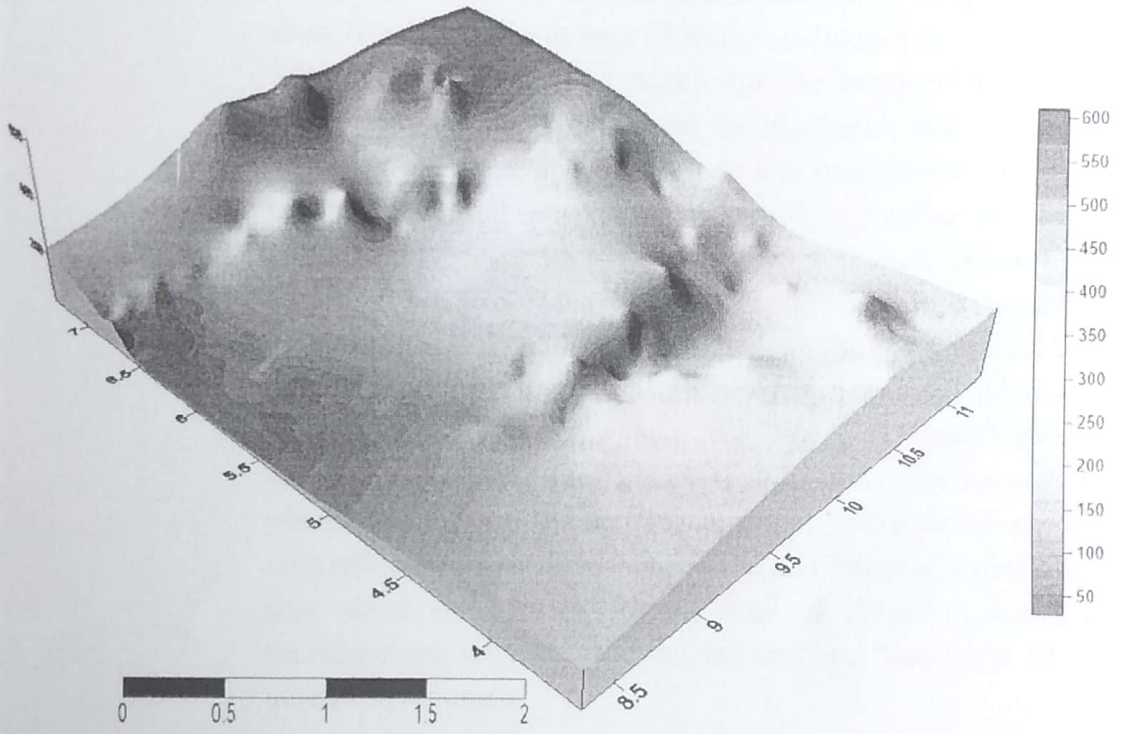

Figure 1: 3D Topographic Map of Niger State
Source: Google earth, 2019

As revealed in Table 1 to 7 in relation to Figure 1, places with low topography has the tendency of low thunderstorm while places with high topography has the tendency of higher number of thunderstorm occurrences as well as high intensity.

Conclusion

The study showed that, the majority of thunderstorms which occur over the region had their origin from Kagoro and the Jos high grounds which are about 1,300m above sea level and the Adamawa axis a high ground too with lots of thunderstorm cells influenced and propagated from the Cameroon Mountains. Also they predominantly occur in the late afternoon and evenings during the unset/session of the raining season, characterized with very strong/gusty winds which may be accompanied with or without rains in some occasion. Another significant finding is that gusty winds of 100km/h and rainfalls of between 30 to 90mm are recorded in few hours of between 3

to 6 hours which are capable of destructions of buildings/structures as well inducing flash flood disasters as seen from the analyzed data.

Also, while records have shown that the length of the raining season are shrinking more and more particularly over the Northern states in both amount and durations, it has been observed that, this region had maintained normal to above normal annual amount of rainfall despite the reduction in number of rain days in some cases and subsequently accounting for the surplus amount of rainfall over the region. Thus making these area of the country to be agriculturally viable and attracts the migration of farming and nomadic communities into the vast arable, fertile and vegetated land. Most importantly, thunderstorms in these area classified or categorized into TS2, TS3 and TS4 in accordance with the World Meteorological Organization (WMO) categorization table and if harnessed properly can be used for National emergency planning for flood disaster management, mitigations, awareness, preparedness and cost reduction measures on both local and National scale. It's therefore recommended that, there should be a proper way of classifying/categorizing data relating to thunderstorm intensity, rainfall amount and frequency of lightening data for easy access on request.

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